The ship's carpenter, who died, slept by himself in the store-room; his was a closed bunk, like all the others. The first mate slept alone off the mess-room, in the after part of the ship; he contracted the disease.

We have then here the following situation: Toxic matters in the atmosphere, either directly by the fermentation of an enormous mass of sugar[1] and the formation of the poisonous compounds of carbon, or by a decomposition of the air depriving it of part of its oxygen. We have a wet trip, the very weather in which beri-beri, or kakké, flourishes in Japan. We have muscles and peripheral nerves more or less exhausted by the pumping work rendered necessary by the leak.

We have, therefore, an image of the disease, accompanied in the most manifest way by all its etiological factors, which leaves nothing to be desired.

The following facts relating to the export of sugars will perhaps be of some interest. Captain Durke tells me that all sugar cargoes in the voyage blacken the paint;[2] he says, however, that unless water gets into the cargo the sugar will not really ferment. He has carried many cargoes from the West Indies, the Barbadoes, and all gave off the blackening gas; but he had never a ship ferment before, nor had he ever an outbreak of beri-beri. Therefore the fermentation is not the cause of the formation of that sulphuretted hydrogen. The elder Mr. Hincken, a sugar broker, one of the consignees, says he has many times entered the holds of incoming sugar ships and always found them sweating from the heat in the hold. It must be noted that in the East Indies lime containing sulphur[3] is used in the preparation (tempering) of sugar for export to prevent fermentation; hence the blackening gases. In the preparation of the cane-juice for export sugar in the Philippines no molasses is formed. This is the only difference in preparation between it and West Indian sugar; in the latter there is always a formation of molasses. It is the addition of an excess of lime to sugar which prevents the formation of molasses, by the more abundant production of saccharates; hence, if the lime is very sulphurous, we naturally have an excess of sulphuretted hydrogen developed. The sulphuretted hydrogen, if you consider these data, can have nothing to do with the disease; it blackened the walls, that is all. The captain has had walls blackened frequently without beri-beri. One question in passing, Why did beri-beri never occur in any ship exporting sugar from Brazil and the West Indies? The cause may be that the trips of these vessels are comparatively short. Moreover, peculiar care is taken of the Brazilian sugar, for it is known to be a very poisonous stuff; that is, to ferment very easily.

Each of the facts mentioned above; that is, emanations of carbonic compounds, exhaustion, tropical wet weather, may not by itself produce beri-beri. But here we have them united, and their union is strong enough to overcome the resistance of Europeans.

I have elsewhere affirmed my belief in the operation of carbonic compounds in the production of kakké in Japan.[4] I think that I have a right to consider this case as strongly corroborating my theory. Dr. Takaki, while admitting the action of the carbonic compounds, supposes them to act in a quite different way from that in which they have evidently acted in this case. He believes carbonaceous food to be the cause of the intoxication. Here the effect was produced by inhalation; this is evident by the indisposition of the ship's dog. That animal, as well as the four men who had not contracted beri-beri, was continually vomiting. If the gas operated to make these beri-beri-free men sick, and it was undoubtedly the gas, it was by being inhaled. Now why should the gas not have produced the disease in the others in the same manner; that is, by inhalation? This does away with the theory of beri-beri intoxication through carbonaceous food.

Dr. Takaki claims to have eradicated kakké, which is the same as European beri-beri, from the Japanese Navy, by the elimination of rice from the diet of the men. That he has eradicated it, I believe. But that it is due entirely to the change in the diet, I do not believe. The men have been at the same time removed from the influence of those fumes of carbon, amidst which the Japanese live and breathe. In Japanese houses charcoal is continually burned for heating and cooking, and the natural humidity of the hot season keeps over everything a deep layer of pernicious gases. In the new navy the men are not exposed to the same influences, their heating being done by steam or coal. The fact that the removal of the beri-beri patients to higher altitudes, where the air is pure, results in improvement is proof positive that the poison is inhaled. This fact, that is, the advantage of altitude, must remind most readers of that unfortunate Neapolitan dog, who inhales the oxide of carbon of the "cave of the dog," for the instruction and amusement of the visitor. The gas, which in this grotto issues from some fissures, is so heavy that it remains in the inferior part of it, and does not reach the nostrils of men; but the dog, breathing in the nether layers, falls down at once in a paroxysm of asphyxia.

It is my opinion, if similar changes in the heating methods to those which were introduced into the navy, were adopted by the people at large the benefit conferred on the navy would become a general, a national one. They have only to stop the burning of charcoal.

That Europeans in Japan rarely contract beri-beri is partly explained by the fact that they are not exposed to charcoal fumes in their houses.

However I do not contend that inhalation of carbonic gases, is the only etiological factor of beri-beri. These factors are necessary: Weakness, produced, on the one hand, by a feeble non-albuminous diet, incapable of maintaining the natural resistance of the body to morbid influences, or by climatic or other like influences,[5] debilitating the muscular fibres and peripheral nerves, and *the toxic influence itself*, that is, the presence of carbonic gases when it continues for a sufficient time.

[1] 10,000 sacks out of 50,000 up to this time unloaded have been involved in the process, and it is expected that about one-third of what remains in the bottom of the bark will be found damaged; that is, about one-fourth of the whole cargo, 500 tons, has suffered.

[2] The ship's paint was black from sulphuretted hydrogen. I tested some of it.

[3] In the Icery process, bisulphite of lime is used.

[4] Univ. Med. Mag., January, 1891. Sei-I-Kwai Med. Journ. XI., No. 2.

[5] The temperature in the ship's cabin, during the entire voyage nearly, was over 80°; in the sun, in the Indian Ocean and tropics, it was as high as 126°. In Japan, kakké occurs in the season when the sun is very hot and the air very damp, and the days when these conditions are particularly oppressive, the patients are regularly worse.

ORIGIN OF THE LINES OF MARS.

BY PROFESSOR HENRY W. PARKER.

ON examining a copy of Schiaparelli's Map of Mars, May, 1889, I called the attention of the geology class of Iowa College to the striking general coincidence in the direction of the lines with those of coast and mountain trends on the earth, and I referred to the observations on these by Professor Benjamin Peirce, and a suggested explanation by Professor James D. Dana. The coincidence must have occurred to many persons; but I find no reference to it except in a paper by the younger Darwin (G. H. Darwin) read before the Royal Society in 1878, and printed in the "Transactions," to which, as dealing with coast-lines, I was recently referred by Professor Wolcott Gibbs and by S. C. Becker of the U. S. Geological Survey. Mr. Darwin's remarks were founded on a previous and probably much less detailed map of Mars in "Appendice alle Memorie della Societa degli Spettroscopesti Italiani," Vol. VII., 1878. His papers (in Parts 1 and 2 of "Transactions," Vol. 170) relating to terrestrial physics are "On the Bodily Tides of Viscous and Semi-elastic Spheroids, and on the Ocean Tides upon a Yielding Nucleus," and "On the Precession of a Viscous Spheroid, and on the Remote History of the Earth."[6] In the latter paper, referring to the dragging of tidal protuberance greater at the equatorial regions than at the polar, and the consequent distortion of a yielding globe, he says:

"The screwing of the earth's mass [as a viscous spheroid in remote ages, his meaning seems to be] varies inversely as the sixth power of the moon's distance multiplied by the angular velocity

[6] For some pertinent comparisons between the physics of the earth and of Mars, with special reference to the state of internal stress of an elastic sphere under tide-generating forces, but with no mention of the lines of Mars, see Mr. Darwin's paper, "On the Stresses caused in the Interior of the Earth by Weight of Continents and Mountains," in the same "Transactions," Vol. 173.

of the earth relatively to the moon. And, according to that theory [in the first paper], in very early times the moon was very near the earth, whilst the relative angular velocity was comparatively great. Now, this sort of motion, acting on a mass which is perfectly homogeneous, would raise wrinkles on the surface which would run in directions perpendicular to the axis of greatest pressure. In the case of the earth, the wrinkles would run north and south at the equator, and would bear away to the eastward in northerly and southerly latitudes, so that at the north pole the trend would be north-east, and at the south pole north-west. Also the intensity of the wrinkling force varies as the square of the cosine of the latitude, and is thus greatest at the equator and zero at the poles. Any wrinkle, when once formed, would have a tendency to turn slightly, so as to become more nearly east and west than it was when first made.

"The general configuration of the continents (the large wrinkles) on the earth's surface appears to me remarkable when viewed in connection with these results. There can be little doubt that, on the whole, the highest mountains are equatorial, and that the general trend of the great continents is north and south in those regions. The theoretical directions of coast-line are not so well marked in parts removed from the equator.

"The great line of coast running from north Africa by Spain to Norway has a decidedly north-easterly bearing, and the long Chinese coast exhibits a similar tendency. The same may be observed in the line from Greenland down to the Gulf of Mexico; but here we meet a very unfavorable case in Panama, Mexico, and the long Californian coast-line.

"From the paucity of land in the southern hemisphere, the indications are not so good, nor are they very favorable to these views. The great line of elevation which runs from Borneo through Queensland to New Zealand might perhaps be taken as an example of a north-westerly trend. The Cordilleras run very nearly north and south, but exhibit a clear north-westerly twist in Tierra del Fuego, and there is another slight bend of the same character in Bolivia."

After speaking of his theory as in accordance with the views of geologists, so far as they hold that the general position of continents is what it was from the first, Mr. Darwin remarks:

"An inspection of Professor Schiaparelli's map of Mars (1878), I think, will prove the north and south trend of continents is something [not] peculiar to the earth. In the equatorial regions we there observe a great many very large islands separated by about twenty narrow channels running approximately north and south. The northern hemisphere is not given beyond latitude 40°, but the coast-lines of the southern hemisphere exhibit a strongly marked north-westerly tendency. It must be confessed, however, that the case of Mars is almost too favorable, because we have to suppose, according to the theory, that its distortion is due to the sun, from which the planet must always have been distant. The very short period of the inner satellite shows, however, that the Martian rotation must have been (according to the theory) largely retarded; and where there has been retardation, there must have been internal distortion."

The later map (*Popular Science Monthly*, 1889) after Schiaparelli's observations in 1888, gives the Martian surface from 70° north to 70° south. The number of lines, including those of so-called islands and coasts, running north-easterly, are about equal to those running north-westerly; although, east of 280° longitude the lines are most strikingly north-westerly for about half the surface of the planet, as any one can observe, inverting the map to bring the north to the top, and the west to the left hand (see "Septentrio" and "Occidens" printed in the border of the map).

Beginning with the west, the longest north-west lines (all double) and their angles with the equator are as follows, indicated by names connected with them: Oreus, 20°; Pyriphlegethon, 47° to 50° (both continued on the east in the map); Hydractes-Phlegethon, 24°; and Antæus-Eunastos, 40°, with virtual long continuations extending it from 40° south to 60° north. The mean inclination of these four is about 34°; and a striking fact is that two are 20–24°, and two 40–45° nearly. The mean of ten most noticeable north-west lines, double or single, is about 42° 44′.

The longest north-east lines, also double, are Gigas, the inclination changing from 40° on the south of the equator to 30° on the north; Phison, 45°; and Erebus-Cerberus, somewhat curved, 25°; of great length, and continued as a single line east through not less than 150° of longitude, The mean is about 43°, excluding the double Jumana, 75°. Twelve conspicuous north-east lines, single or double, have a mean inclination of nearly 50° 45′. A few others are north and south, or so nearly so as to be counted such.

For comparison, a map of the earth on Mercator's projection must be taken. The mean of ten of the most noticeable north-western trends of coast, mountain, or depression is 60°, as against 42° 44′ in Mars. The mean of fourteen north-east is about 46° 25′, as against 50° 45′ of the twelve above mentioned in Mars, — a striking similarity. The great features, running north and south, are few, as in Mars; viz., the southern Andes, the Ural Mountains; and the less-known chain of eastern Africa.

Mr. G. H. Darwin's theory is, so far as known to the writer, the best one for the earth, and the only one fairly worked out, though, as Mr. Darwin acknowledged, it is poorly consistent with the earth's great north-west lines, and is seemingly opposed to the tidal probabilities of Mars, which has two small but near moons of different revolution. It would be exceedingly interesting if some mathematical astronomer would work out the complicated problem of the tides of Mars (perhaps considerable at conjunctions) on the supposition that its surface was all water. But Mr. Darwin partly dismisses the moons, and refers to the action of the sun, which, however, he thinks must have been inconsiderable. This reference is curiously coincident with a reported suggestion by the late Professor Benjamin Peirce that our continental trends might be due to the "action of the sun." I cannot get from his son, through a friend, any reference to a record of his view; only that in a perhaps unpublished paper, or on some occasion, he called attention, as everyone knows he did, to the remarkable fact that the continental trends are great circles of the sphere tangential to the arctic and antarctic circles, — a fact with some striking illustrations, but not universal. Professor Dana credits the first observation of this to Robert Owen, in his "Key to the Geology of the Globe," 1857.

Professor James D. Dana suggested that the great lines of the earth might be due to a system of cleavage comparable to that of crystals.[1] He refers to parallelism observed in the crystals of a solidifying mass, but does not give particulars. In some crystalline rocks, e. g., gneiss, the parallelism conforms to layers of deposit, and here and in other instances may also have to do with pressure. How it is in respect to unstratified metamorphic rocks is a question to be determined by observation. There is one fact on a limited scale that may have some weight; it is that, in cavities and fissures, implanted crystals have been observed to have uniform alignment to the horizon and points of compass,—similar faces of like crystals flashing simultaneously in the light. The importance of this fact, so far as it holds true, is that the arrangement must depend on some other force than molecular attractions; it may be from a very far-reaching cause, sufficient to produce lines of weakness, here and there, that became concurrent. Perhaps we shall have to fall back provisionally on that fetish of the ignorant and the semi-scientific, "electricity," supposed to explain everything from a tornado to a nervous twinge. In this case it might have a color of possibility, if it be true that

[1] "Cleavage Structure in the Earth's Crust.—The prevalent north-east and north-west courses of trends, the curves in the lines varying the direction from these courses, and the dependence of the outlines and feature-lines of the continents and oceanic lands upon these courses (p. 29) are the profoundest evidence of unity of development in the earth. Such lines of uplift are lines of fracture or lines of weakest cohesion; and, therefore, like the courses of cleavage in crystals, they show by their prevalence some traces of cleavage-structure in the earth, — in other words, a tendency to break in two transverse directions rather than others.

"Such a cleavage-structure would follow from the mode of origin of the earth's crust. The crust has thickened by cooling until now scores of miles through; and very much as ice thickens — by additions to its lower surface. Ice takes a columnar structure, perpendicular to the surface, in the process, so as often to break into columns on slow melting. The earth's crust contains as its principal ingredient one or more kinds of feldspar, all cleavable minerals; and, as crystals on slow solidification often take a parallel position, so it might have been in the cooling crust. This appears the more probable when it is considered with what extreme slowness the thickening of the crust has gone on, and the immeasurable length of time it has occupied."—Dana's "Manual of Geology," 1876. pp. 737–8.

earth-currents have anything to do with such dispositions of matter as the renewed deposit of ores asserted of certain dry mines and tunnels; but no rock-bed, probably, is dry enough to demand such an explanation, which itself requires a great deal of explaining.

In this connection I will add that a hexagonal crystallization in Mars, occurring to the mind of one of your correspondents, is as wild as the canal idea. The radiating lines are on too vast a scale; and there is nothing in any known crystallizations to favor the idea, unless it be the little six-rayed stars of frost spicules, from which the jump to Martian continents is too great. The radiations have their counterpart in the old volcanic surface of the moon and some analogous facts on the earth; also in mountain system "knots," Himalayan or other.

On the whole, the action of lunar and solar tides on planets while in a viscous condition, with more or less crust, is the only hypothesis that so far promises well, in explanation of the remarkable lines of the earth and Mars, notwithstanding the difficulties mentioned.

Yonkers, N.Y., Oct. 27.

RESIDUAL PERSONALITY.

BY ARTHUR E. BOSTWICK, PH.D., MONTCLAIR, N. J.

EVIDENCE is not wanting to show that what we call personality is an extremely complex thing, the sum of subsidiary personalities which now shift and change like the figures in a kaleidoscope, and again, becoming sharply defined under some abnormal condition, crystallize into two or more distinct groups of elements, which alternately sleep and wake or even co-exist. These complex elements may be so unstable, the groups composing them constantly breaking up and forming new combinations, that the idea of multiple personality does not naturally attach itself to them; it is only when they become stable, and especially when each exhibits a well-defined consciousness, that we begin to think of such a thing. But, besides the abnormal and diseased conditions which cause such a separation or crystallization, there are other conditions in which it appears somewhat less distinctly. To one class of these I desire to call attention very briefly — to that embracing what may be called cases of residual personality.

Residual phenomena of all kinds are particularly interesting and instructive, especially those where the few things remaining in a group after many have been removed differ widely in their collective properties from those that have been taken away, while these latter are not in any way distinguishable from those of the sum of both before the division. This is the case often with residual personality. Nothing is more common than for a group of elements in what we call a person to be differentiated in one of various ways, leaving behind a residual group differing altogether in its characteristics, though the differentiated group represents to us, and is indeed considered to be identical with, the original person.

The commonest method of such differentiation is sleep. The elements which sleep, are, as it were, subtracted from the normal personality, but there is usually left behind a very curious something — illogical, credulous, fantastic — whose nightly experiences the whole re-united person recollects in the morning as dreams. The next commonest case is that of the absent-minded person. The major part of the person being absorbed in mental processes of some sort, the residual person lives its own separate mental life, thinks, feels, and wills by itself, and perhaps carries on a train of processes which is continuous with a preceding train carried on under similar circumstances the day before. This residual person may act very mechanically; the re-united person may fail to recollect what its acts or thoughts were and be surprised to find how it has been making use of his limbs while he — what he vainly regards as the one unalterable ego — has been absorbed in thought; but, on the other hand, it may be perfectly conscious, and may carry on an entirely different train of thought of its own. Almost always, however, it is eccentric, and betrays a weakness at one point or another.

For instance, a suburban resident, whom we will call A, is accustomed on landing at the New York side of the ferry to abandon the mechanical task of walking to his office entirely to his residual personality, and to give up the major part of himself to thought. The two personalities act often with perfect — always with practical — separateness, the residual person being quite equal to the low task of evading vehicles, steering clear of passers-by, and turning the proper corners. When the office is reached and the two persons again become one, it is often a difficult task to remember any circumstances of the walk. On one occasion, however, A left the Astor Library on Lafayette Place, as he supposed, intending to walk down Clinton Place. To do this he must turn first to the left, then to the right, and then again to the left. He turned once to the left, and after some time became dimly conscious that he had walked for a long time, and that the place for the second turn had not been reached. Coming to himself, he found himself far down Broadway. Tracing back his course mentally, he discovered that he had been in the Mercantile Library instead of the Astor; his first turn therefore had taken him down Broadway, and he of course did not reach the place for the second. Mark now the peculiarities of his residual person. It knew just where it was to turn and in what direction, and had sense enough to be uneasy when it did not come to the proper place to turn, but it had not intelligence enough to know that it was on the wrong street. Its mind was too weak to be trusted further than it was accustomed to go. This residual person, in short, was about on a par with a harmless idiot.

Again, B, a New Yorker, is walking along absorbed in a process of thought, when his residual personality sees his friend C approaching. It is not astonished, for he is near C's lodgings, but as the person supposed to be C comes nearer, it sees that he only slightly resembles C; he has on shabby clothes, and his face is entirely different. The natural conclusion would be that the person approaching was not C. The residual person, however, does not argue thus. It concludes at once that C has greatly changed; that he has become poor, and that his appearance has altered for the worse. Pity and surprise are plainly felt by the residual person. During these mental processes, so similar to those of a dream-residual, the major person has kept on with his own train of thought. Finally, however, on the close approach of the supposed C, they unite in a flash into the normal person, the two separate consciousnesses become one, and the truth is recognized at once. No doubt these cases can be paralleled by thousands of others. It seems to me that they are as true instances of double personality as any exhibited by epileptic or hypnotic persons.

Why should the residual person differ so from the normal, while the differentiated person is precisely like the normal? If we take 199 gallons of water from 200, is not the remaining gallon still water? There are many mathematical analogies. In geometry, if we draw a parallel to the base of a triangle we thereby cut off a precisely similar triangle, yet what is left has no resemblance to a triangle. This analogy, carried out, would point to a consideration of personality as a function of position or arrangement of elements, as chemical isomers are functions of the position of their constituent atoms. But an algebraic analogy, which ties us down to no such hypothesis, probably comes nearer the truth. Consider the identical equation $(X + Y) - (a X + b Y) = (1 - a) X + (1 - b) Y$. If $a = b$, the ratio of the two terms of minuend, subtrahend, and remainder, each $= \frac{X}{Y}$. But if a and b differ very little from unity and from each other, then $\frac{a}{b}$ may be sensibly unity, while $\frac{1-a}{1-b}$ differs greatly from it, and thus the ratio of the terms of the subtrahend will be sensibly that of the terms of the minuend, while that of the terms of the remainder may differ greatly from both. In the same way, by extending the number of terms, we may subtract from any polynomial what is sensibly a sub-multiple of it, and yet leave a remainder whose terms bear a very great disproportion. Hence it is, no doubt, that the removal of a group of elements of personality that seems to represent one's normal self may leave a residue so different and so incongruous.

It will be observed that what has been said is entirely independent of any hypothesis as to the nature of the elements of personality and the mode of their combination.